

Shock: Early Detection, Critical Assessment and Escalation

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10/9/2026



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Learning Objectives

- Recognize the early signs and physiologic changes associated with the different types of shock
- Evidence-based escalation strategies to improve outcomes in patients with shock



Cardiogenic Shock – Definition

CS is defined as a state of tissue hypoperfusion and end organ dysfunction owing to a primary cardiac disorder with low cardiac output (CO)

ISHLT/HFSA guidelines (JCF 2023)



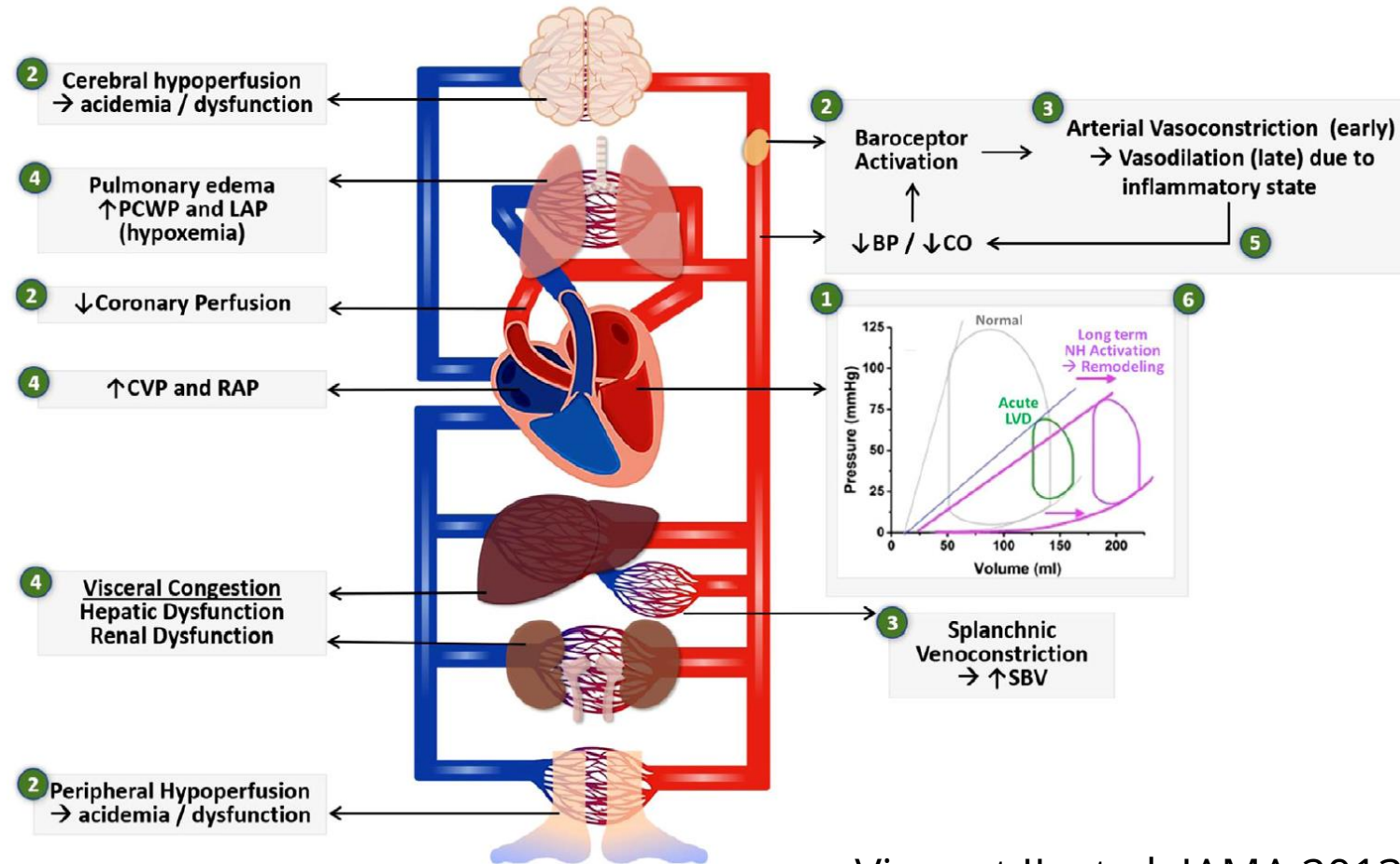
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Pathophysiology

Early recognition of shock hinges on **detecting tissue hypoperfusion** (lactate, **organ dysfunction**) before overt hypotension develops, **compensatory vasoconstriction** can maintain a normal or near-normal blood pressure well into circulatory failure—particularly in previously hypertensive patients.

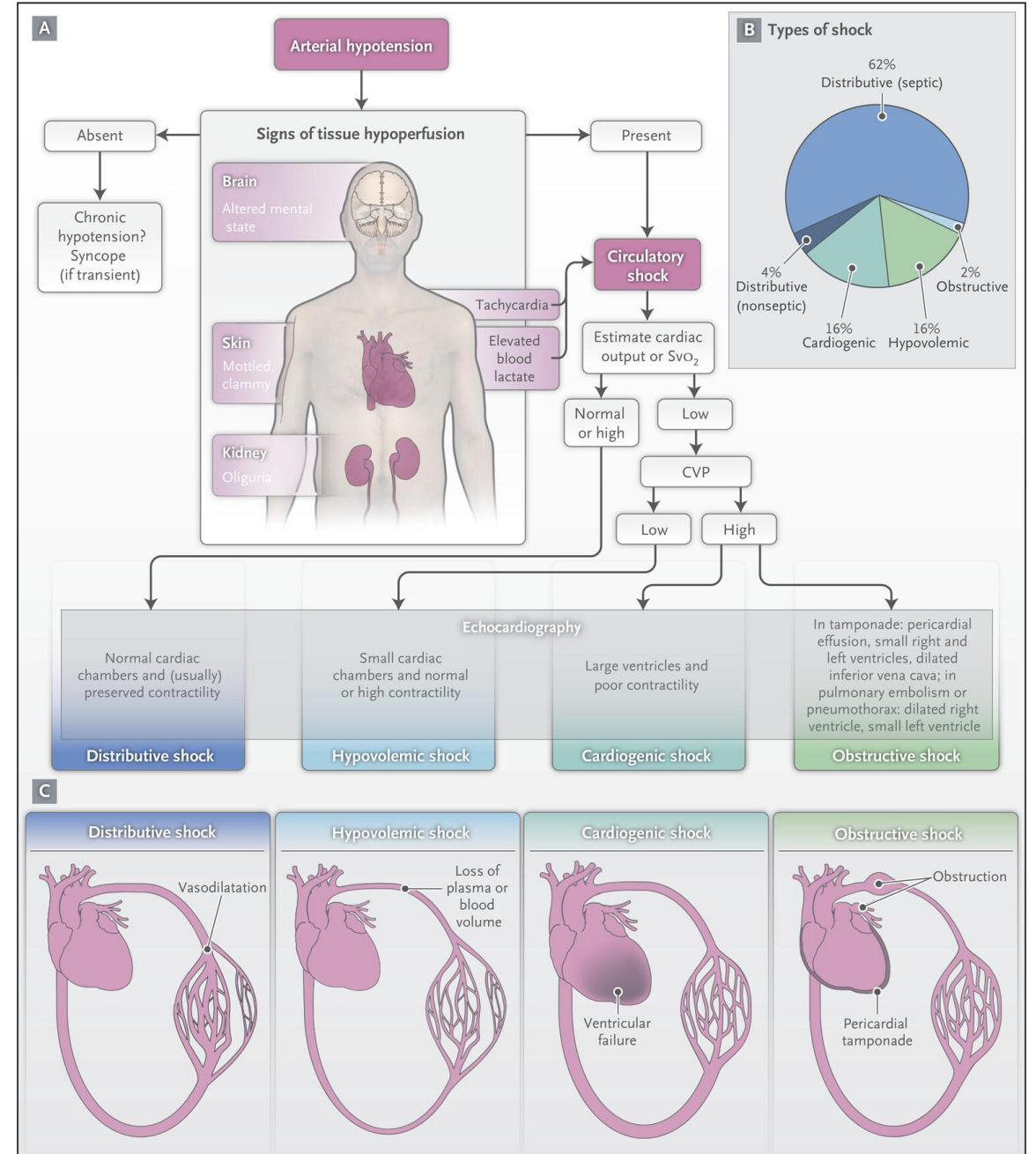


Vincent JL et al. JAMA 2013
Abraham J et al. JCF 2021

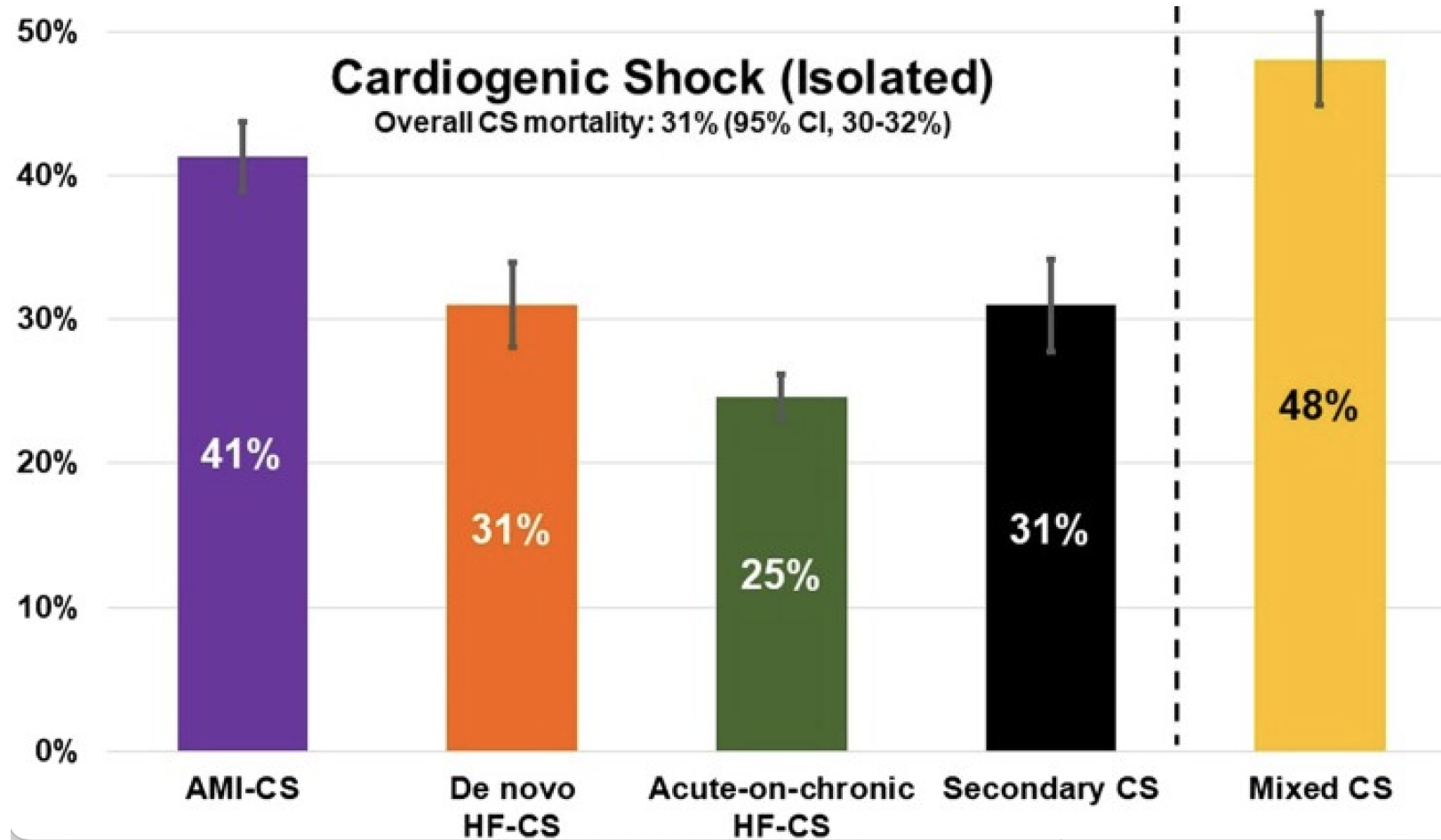
Differential Diagnosis

1. Cardiac output
2. Central Venous Pressure
3. Echocardiogram

Vincent JL et al., JAMA 2013

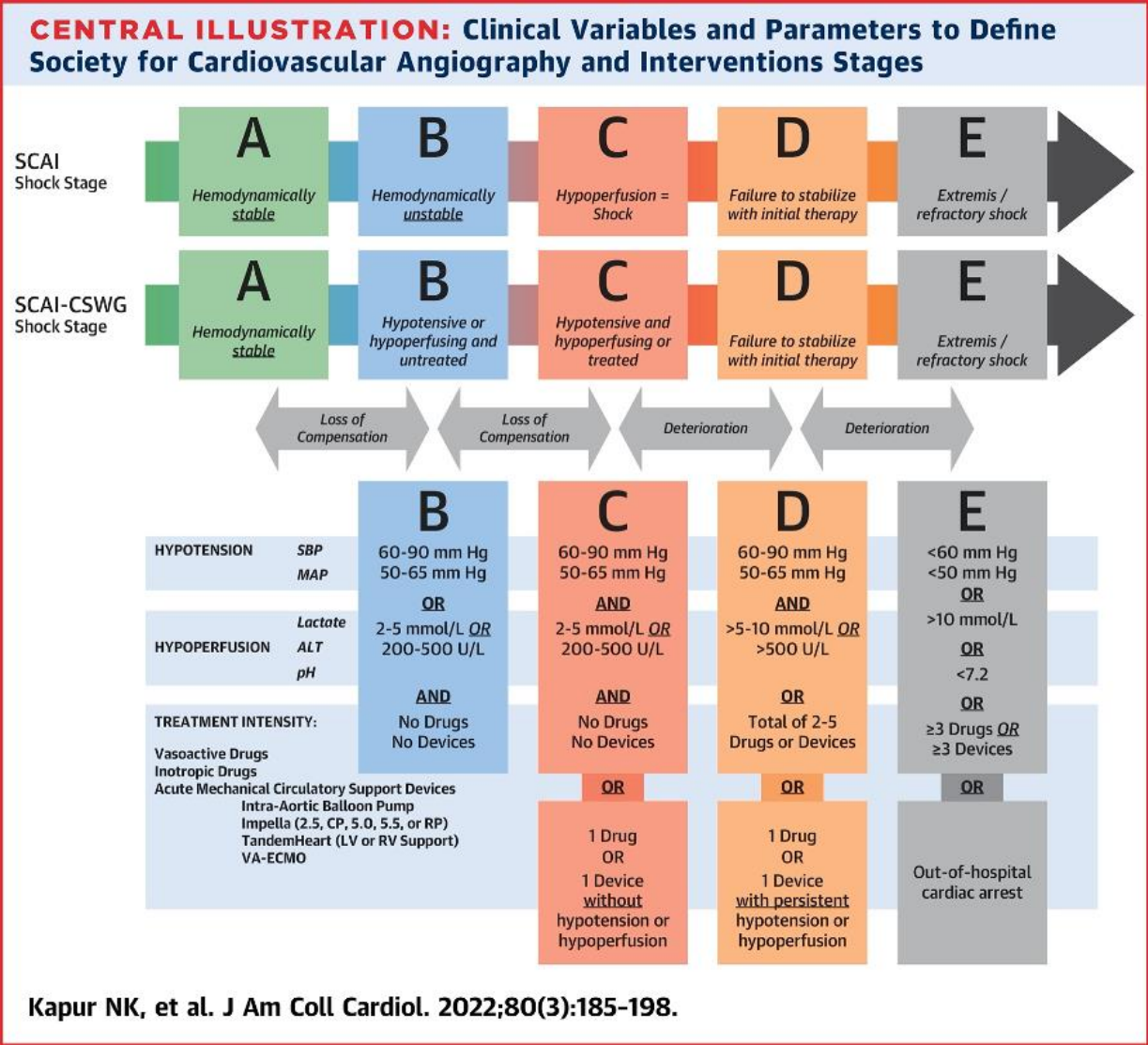


Mortality by Etiology

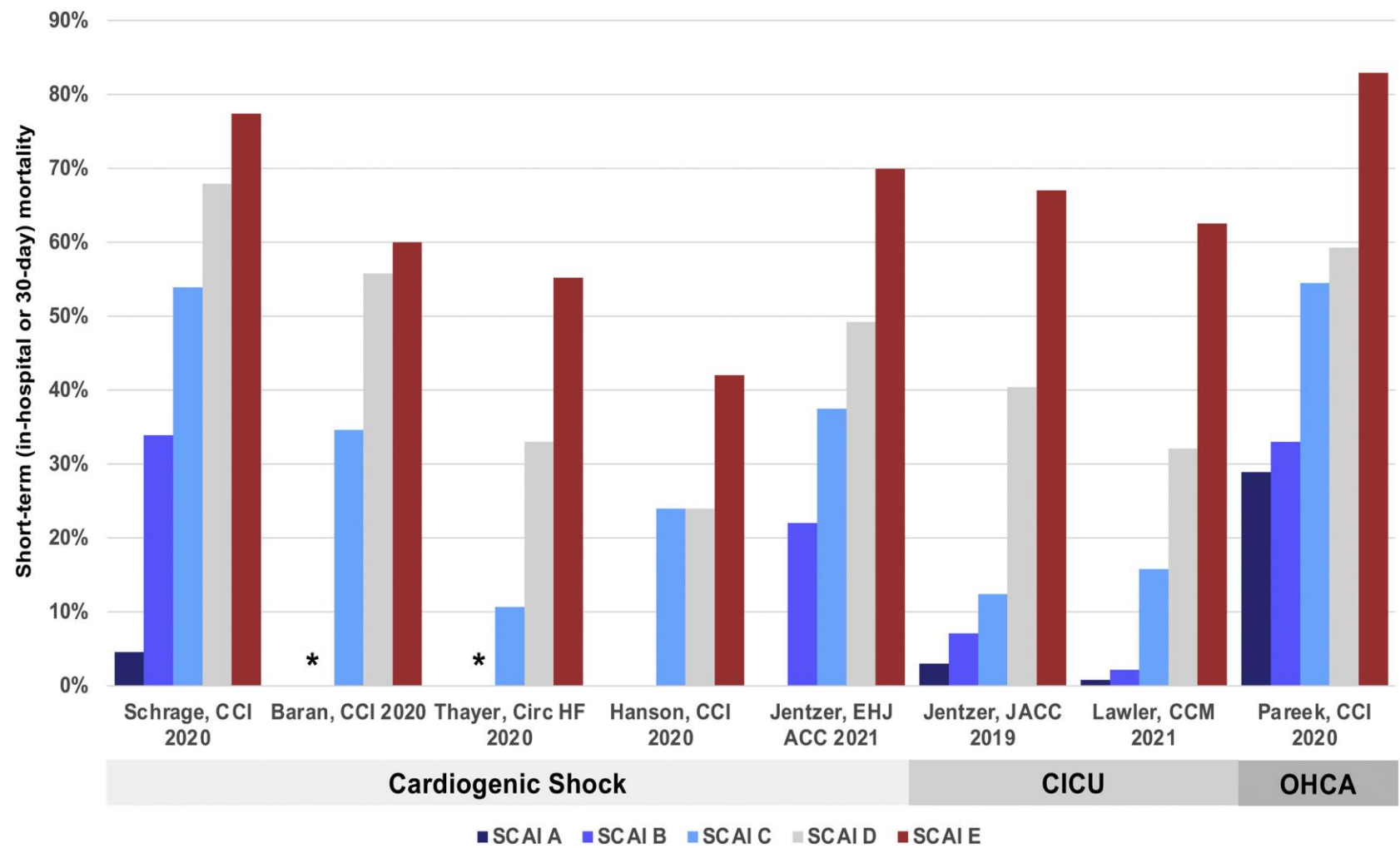


Berg D. et al., Eur Heart J Acute Cardiovascular Care, 2024

SCAI Classification

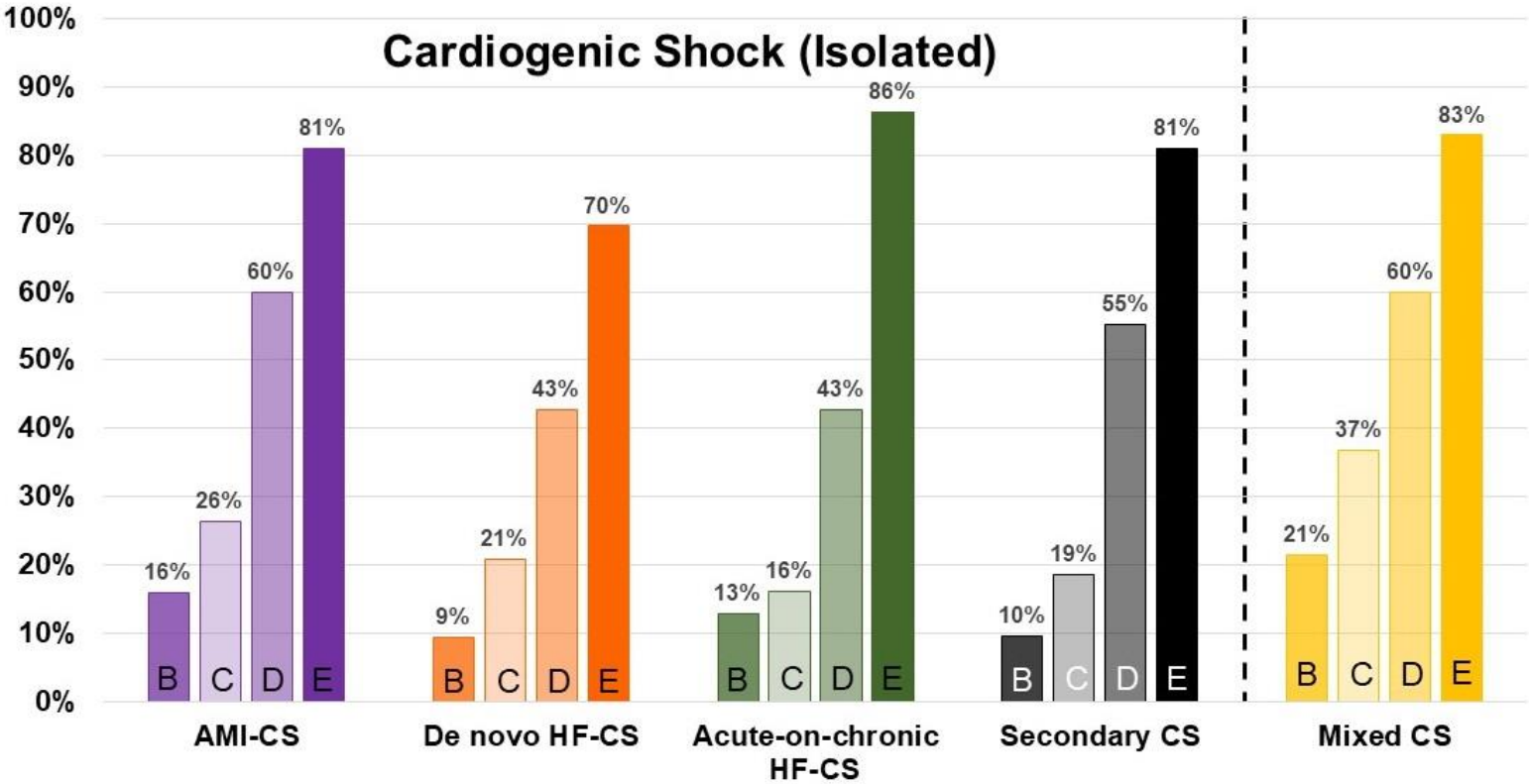


Mortality by SCAI Stage



Nadu et al. , JSCAI, Jan 2022

Mortality by SCAI stage and Etiology

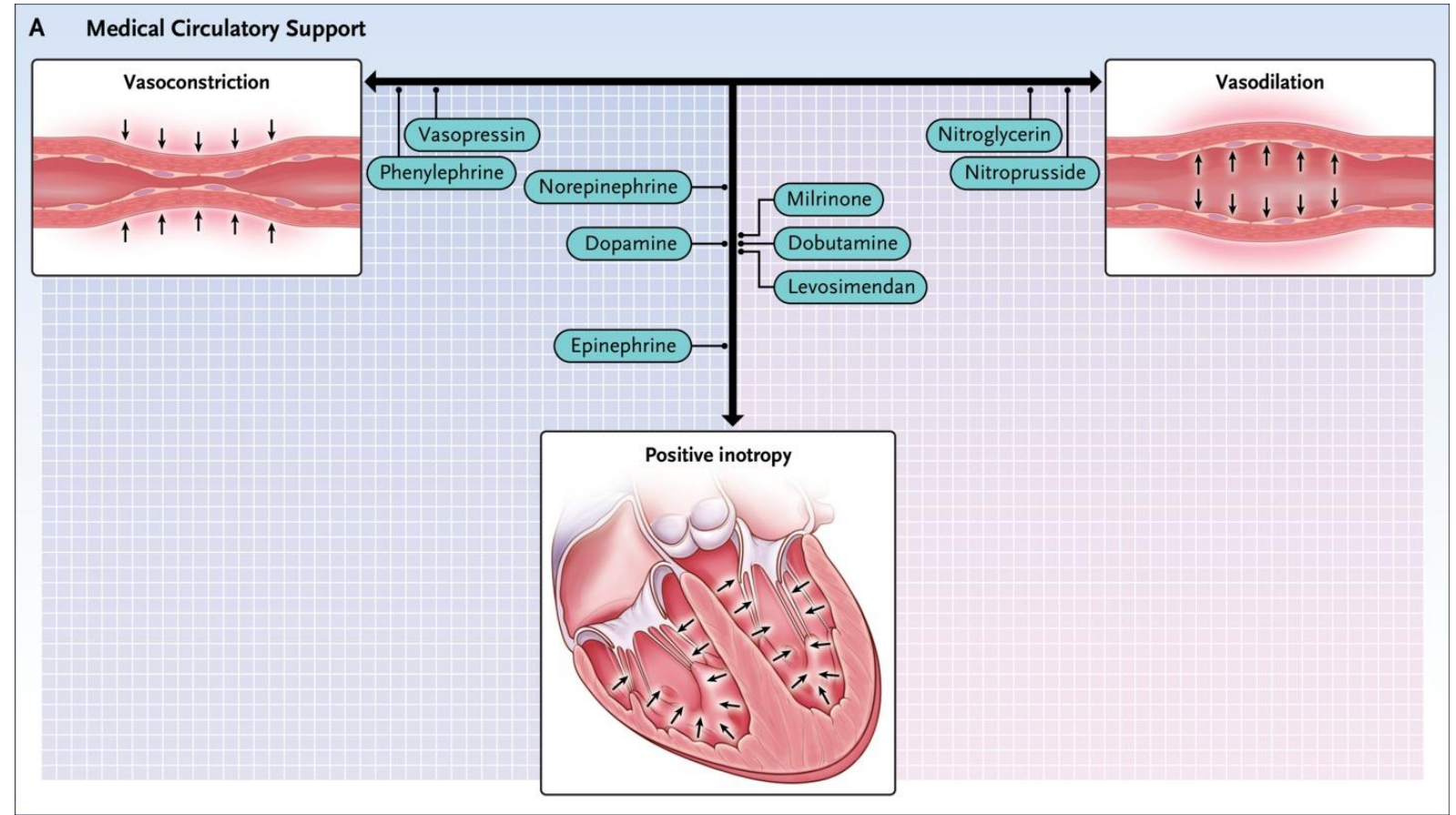


Berg D. et al., Eur Heart J Acute Cardiovascular Care, 2024

Initial Stabilization/ Revascularization

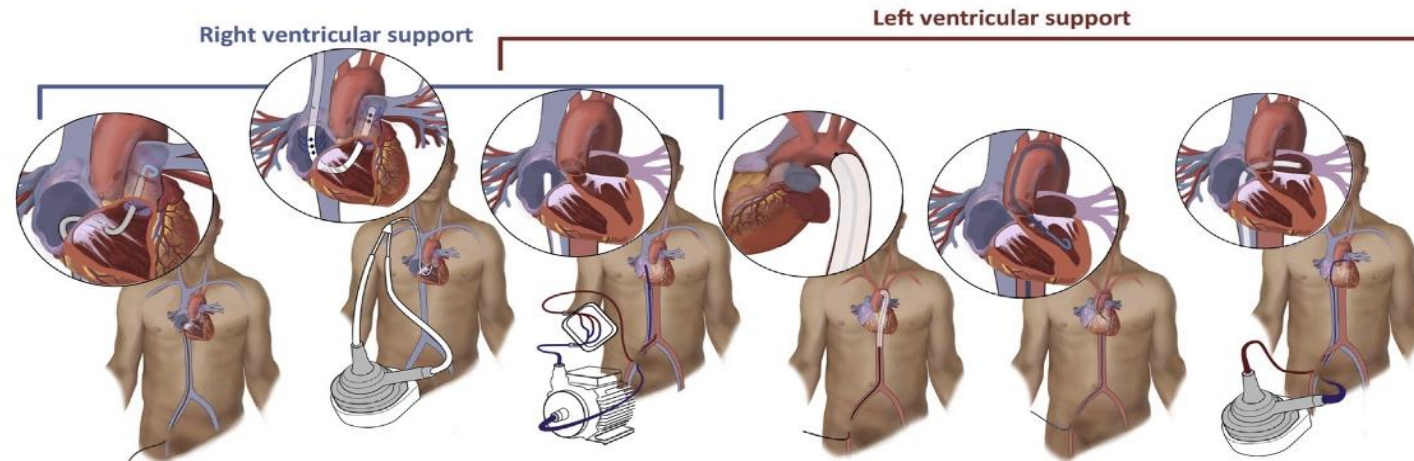
About 50% of patients with AMI CS will need medical therapy alone.

- SHOCK TRIAL: early revascularization
- CULPRIT- SHOCK TRIAL: culprit lesion revascularization



Thiele H, Hassager C. NEJM 2026
Hochman JS et al. NEJM, 1999
Thiele H et al., NEJM 2017

FIGURE 2 Current Mechanical Circulatory Support Devices Used for the Treatment of Cardiogenic Shock



	Impella RP	TandemHeart RA-PA	VA-ECMO	IABP	Impella (2.5, CP, 5.0, 5.5)	TandemHeart LA-FA
Flow	max 4.0 l/min	max 4.0 l/min	max 7.0 l/min	0.5 l/min	2.5 - 5.5 l/min	max 4.0 l/min
Pump Speed	33000 rpm	max 7500 rpm	max 5000 rpm	NA	max 51,000 rpm	max 7500 rpm
Mechanism	Axial flow continuous pump (RA-to-PA)	Centrifugal flow continuous pump (RA-to-PA)	Centrifugal flow continuous pump (RA-to-AO)	Balloon inflation-deflation (AO)	Axial flow continuous pump (LV-to-AO)	Centrifugal flow continuous pump (LA-to-AO)
Cannula Size	22 F venous	29 F venous	14-19 F arterial 17-21 F venous	7-8 F arterial	13-21 F arterial	12-19 F arterial 21 F venous
Insertion/Placement	Femoral vein	Internal jugular vein	Femoral vein Femoral artery	Femoral artery Axillary artery	Femoral artery Axillary artery	Femoral artery Femoral vein
LV Unloading	-	-	-	+	++ to +++	++
RV Unloading	+	+	++	-	-	-
Cardiac Power	-	-	↑↑	↑	↑↑	↑↑
Afterload	-	-	↑↑	↓	↓↓	↑
Coronary Perfusion	-	-	-	↑	↑	-
Considerations	- RECOVER RIGHT: 73% survival-to-30 days in RVF post LVAD, AMI or cardiectomy - May 2019 - FDA post-approval study: 33% survival-to-30 days	IJ access may facilitate early ambulation	- Bi-V + oxygenation support for CS following: - AMI, ADHF or cardiac arrest - Cardiectomy - Myocarditis - Allograft rejection	- Requires stable cardiac rhythm and native heart function - May consider in select cases of post-AMI mechanical complications	- June 2008 – FDA 510(k) approval for HR-PCI - April 2016: Expanded Indication for CS - Contraindicated with mechanical aortic valve, LV thrombus	- Requires transseptal access - Oxygenator may be added to the circuit

MCS – the Evidence

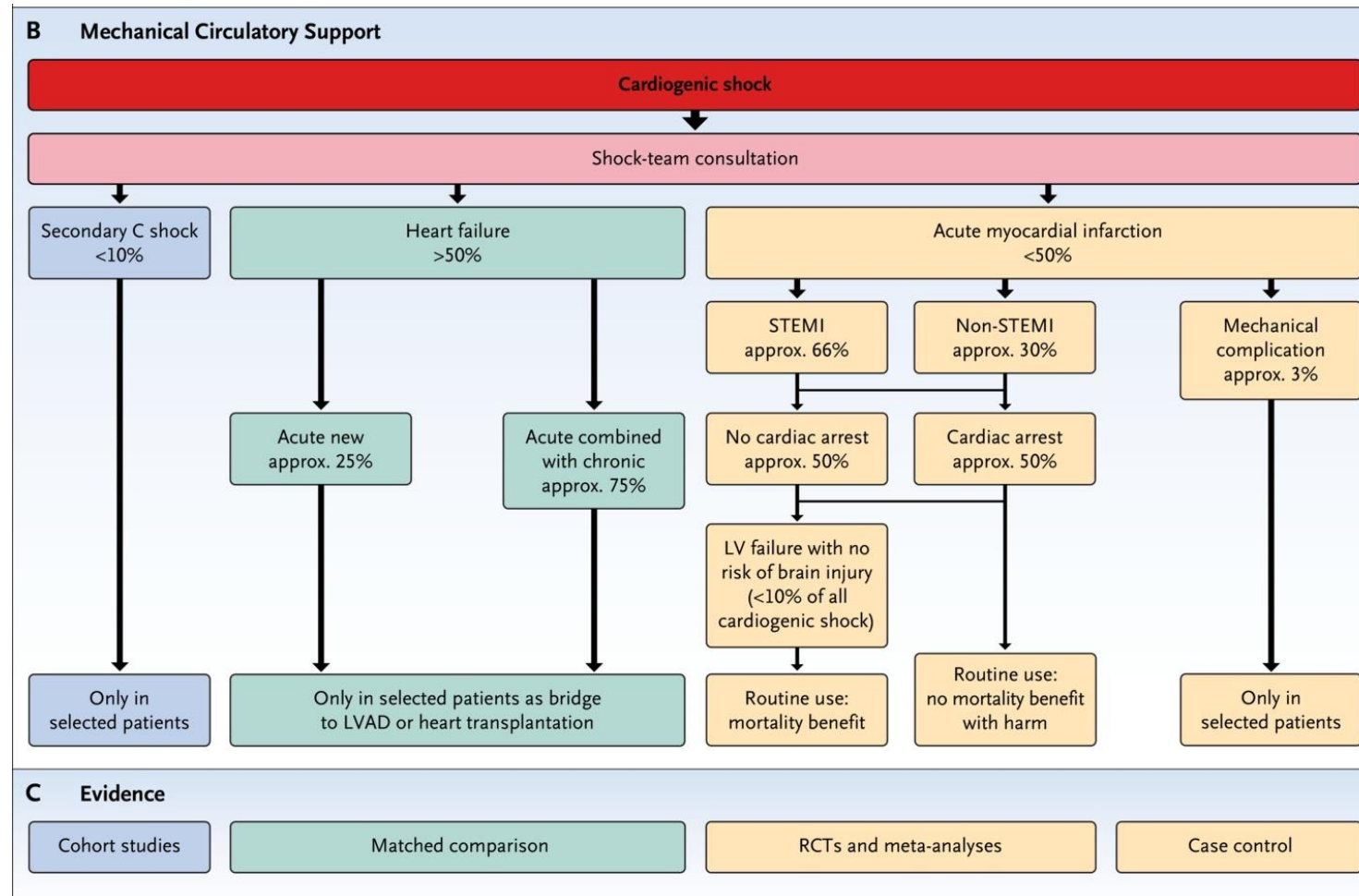
Cardiogenic shock in MI patients

1. IABP –SHOCK II: N= ~ 600, IABP vs medical therapy. **No difference** in mortality
2. IMPRESS: N= 48, microaxial flow pump vs IABP, **no difference** in mortality
3. ECLS-SHOCK: N= 420, early ECLS vs standard treatment. **No difference** in mortality, significant device associated morbidity
4. DanGer- Shock: N=334, microaxial flow pump vs standard of care, **180-day mortality was lower** with MCS but vascular complications, hemolysis, bleeding were higher

Cardiogenic shock in heart failure patients

1. ALTSHOCK: N ~ 100, early IABP vs. standard of care, **no difference** in mortality

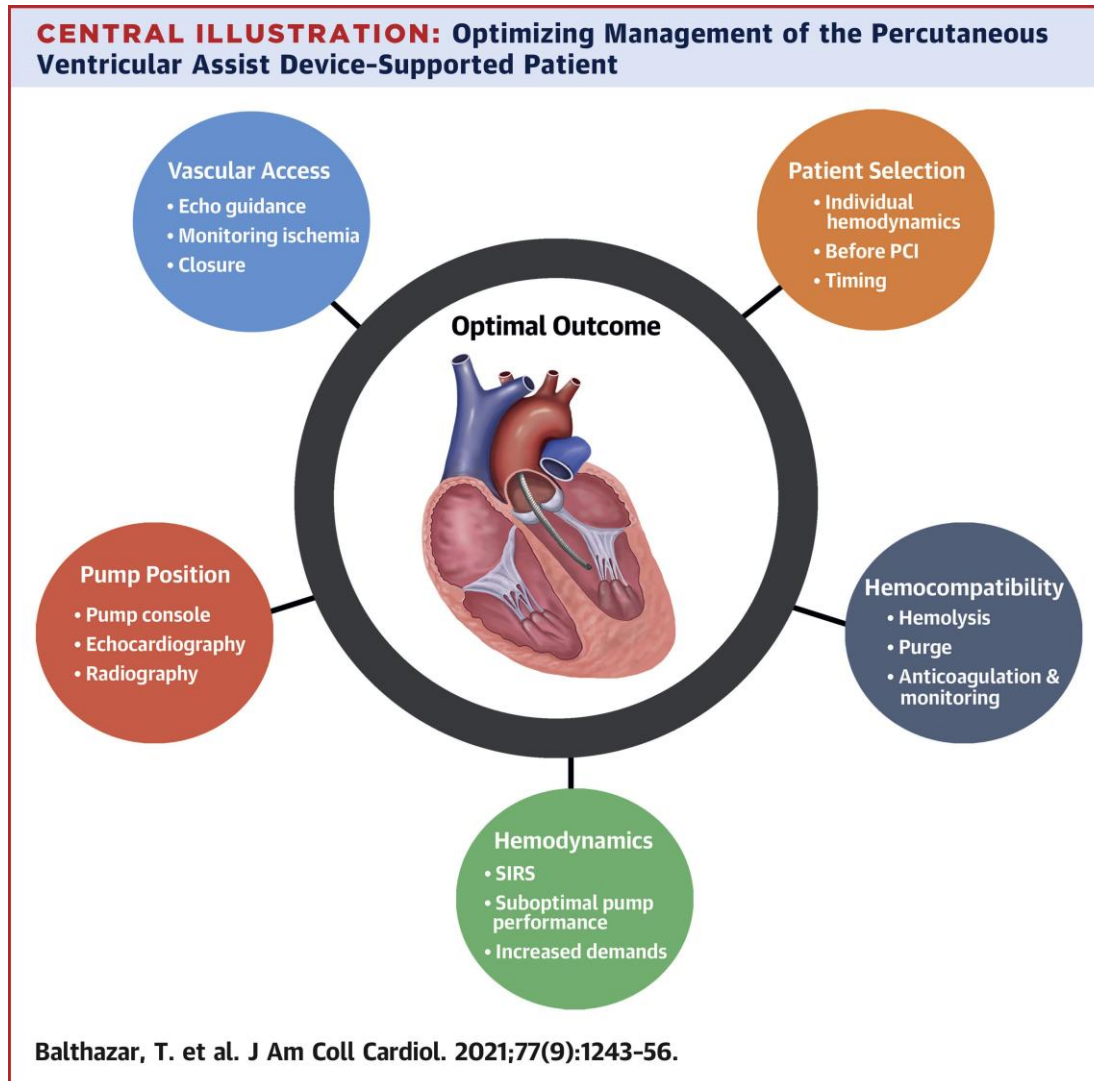
Summary of the Evidence



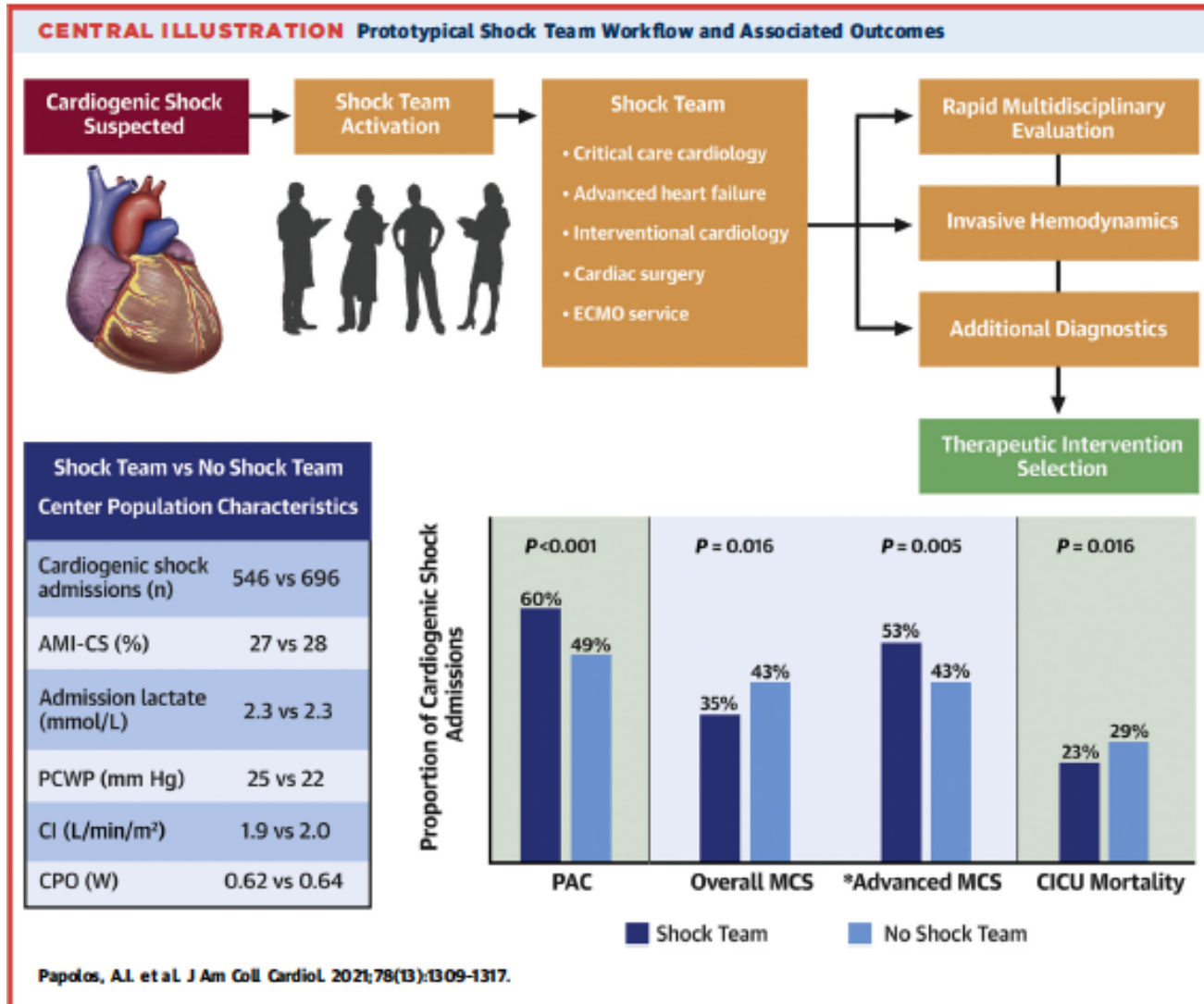
Thiele H, Hassager C. NEJM 2026



How Do We Improve Outcomes?



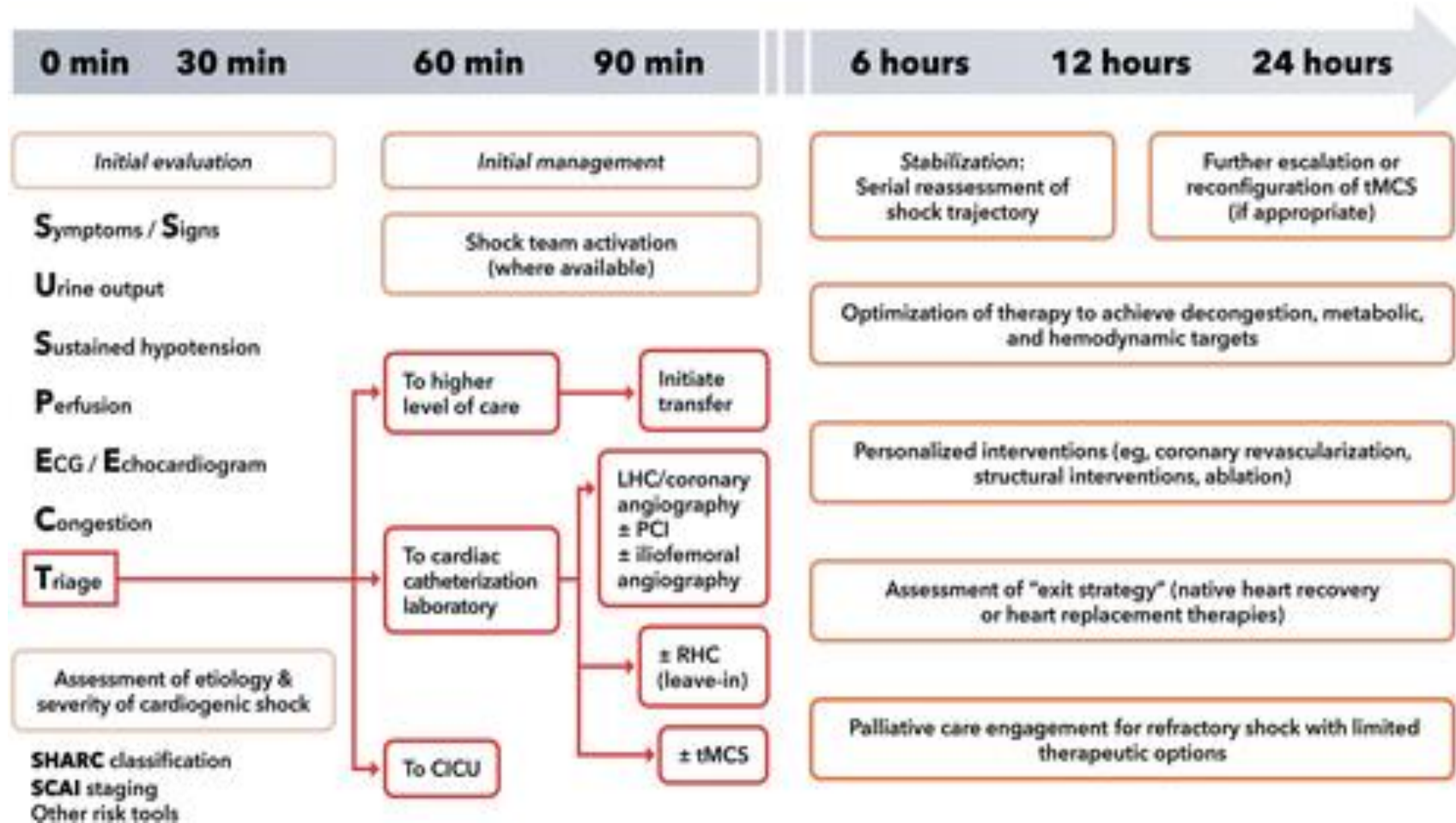
Coordinated response: SHOCK TEAM



Recent meta-analysis of predominantly observational studies showing reduction in 30-day mortality with hemodynamic monitoring in shock.

The benefit was more pronounced in those studies utilizing PAC and for cardiogenic shock.

The First 24h: a Roadmap



Sinha S. et al. *JACC* 2025; 85:1618-1641

Take home messages

- Recognizing hypoperfusion is key for early detection of shock
- Invasive hemodynamic assessment and monitoring allows for timely diagnosis and can improve outcomes in cardiogenic shock
- It is not the pump that saves lives, it is the team



Thank You!

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